A Place-Based STEM Curriculum for 3rd Grade

Landforms, Watersheds, & Vegetative Function

Project WET activities and philosophies inspired several components of this curriculum.

Developed through a collaborative effort to connect students with the science of their schoolyard—from erosion and stormwater to native plants and water quality.

NORTH CAROLINA Department of Environmental Quality DEQ Water Resources

project WET WATER EDUCATION TODAY

COASTAL CAROLINA RIVERWATCH

AmeriCorps North Carolina

PIEDMONT TRIAD REGIONAL COUNCIL

Acknowledgements

This curriculum is the result of a joyful and collaborative effort among educators, environmental professionals, and community partners committed to building water literacy and stewardship in our youngest learners.

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This project would not have been possible without the collective contributions of:

- The **North Carolina Environmental Education Certification Program** for creating a pathway for educators to grow and share their skills.
- The **students**, whose questions and observations made each lesson more meaningful.
- The **teachers and school staff** who demonstrate the value of science learning every day.

We are honored to have learned, explored, and grown together through this shared work.

Overview of These Activities

A lot of these activities are completed outside. Just remember: A lot of the learning experience is done through reflection. Anything that includes a campus walk is student-inquiry driven and the heavy "teacher" part is done through providing questions and reflecting after the walk is completed.

The concept behind this activity series begins with understanding landforms, builds towards understanding water movement around those landforms, and then connecting the function of plants (roots) and the protection/conservation of these landforms on their campus. **By the end of this lesson series, students should be able to identify how landforms, plants, and human activity on their campus impact how the water flows off their campus.**

Pro-Tips:

- Use these activities in order, out of order, or cherry-picked.
- Everyone teaches differently, everyone's comfort zone is different, and everyone is passionate about different aspects of science. If you're having fun, so are the students.
- It's always best to establish/remind students of ground rules and expectations before each activity. Try to be consistent.
- Set high expectations- if students call-out without raising their hand, stop and wait for respect. It's ok to expect respect.

1- Intro to Landforms

Lesson Plan: Finding Landforms on Campus

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

ESS.3.2.1 - Use models to compare Earth's salt and freshwater features (including oceans, seas, rivers, lakes, ponds, streams, and glaciers).
ESS.3.2.2 – Use models to compare Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands).

STEM Focus:

Observation, classification, inquiry-based science, environmental literacy

ELA Extensions:

W.3.2 – Write informative texts to examine a topic with facts and definitions.
W.3.6 - Recall or gather information, take notes, and sort evidence into categories.
SL.3.4 – Report on observations using appropriate facts and clear sequencing.

Math Extensions:

3.MD.4 – Generate measurement data and represent it with a line plot (e.g., record counts of types of landforms seen).
3.G.1 – Understand categories of shapes (compare landform shapes).

Lesson Duration: 60 minutes

Lesson Focus: Understanding erosion, the role of vegetation in preventing erosion, and the concept of stormwater runoff. ← Students will do something aligned to the standards about landform Identification, but also recognizing that landforms have a direct relationship to how water moves and drainage.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Recognize landforms on their campus.
2. Identify and describe the process of erosion.
3. Understand the role of vegetation in preventing erosion and managing stormwater runoff.

4. Connect their observations of the schoolyard's landscape with how water moves and the importance of plants in the water cycle.

Materials Needed:

- Large plastic trays or shallow containers (for erosion simulation)
- Soil (sand and dirt)
- Watering cans or spray bottles filled with water
- Small plants or grass (for vegetation)
- Small plastic figurines or markers (to represent buildings or trees, optional)
- Journals or worksheets for observations
- Whiteboard and markers
- Vocabulary cards with terms: Erosion, Runoff, Vegetation, Watershed, Infiltration

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Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

- **Objective**: Refresh student's understanding of key terms related to water movement and erosion. Put these images on a screen to learn new terms. Key Vocabulary can be written/listed on the board. Try to include: ditch/erosion/mountain/hill/soil

Activity:

1. After reviewing vocabulary, break students into groups and give each group a landform card.
2. Take students outside and walk around campus. Have students look for their landform. And if they see it, have them go stand/jump/do something fun around that landform.
3. When students find the landform, have the whole class come visit the group. Have the landform group read out the "clues" about the landform from their card.
4. Do this with each group. Some landforms may be very small scale (canyons may be little eroded ditches).
5. Come back inside and run the Landforms Kahoot.

Key Questions:

- What do we mean by "erosion"?
- How does "runoff" happen? Where does the water go?
- Why are "vegetation" and "plants" important for the land?

Resource Links:

For Fun: Explore Google Maps Satellite View and River Runner

Supplemental Books:

"Mountains" by Seymour Simon
- Lexile Level: 890L
- Explores the formation and characteristics of mountains with vivid photography.

"Earth's Landforms and Bodies of Water" by Natalie Hyde
- Lexile Level: 940L
- Covers various landforms and water features and how they are formed.

"What Shapes the Land?" by Bobbie Kalman
- Lexile Level: 860L
- Explains processes like erosion and tectonic activity that shape land.

"Rivers and Streams" by Patricia Miller-Schroeder
- Lexile Level: 900L
- A focused look at flowing water systems and their role in shaping the land.

2- Modeling Landforms with Wax Paper

(Inspired by Project WET)

Lesson Plan: Finding Landforms on Campus

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

ESS.3.2.1 - Use models to compare Earth's salt and freshwater features (including oceans, seas, rivers, lakes, ponds, streams, and glaciers).
ESS.3.2.2 – Use models to compare Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands).

STEM Focus:

Scientific modeling, spatial awareness, systems thinking

ELA Extensions:

RI.3.3 – Describe relationships between scientific ideas in a text (if using reading passages).
W.3.7 – Conduct short research projects (e.g., about local watersheds).
SL.3.4 – Report on observations using appropriate facts and clear sequencing.

Math Extensions:

3.MD.3 – Create bar graphs to show water collection at various "valley" points.
3.G.1 – Understand categories of shapes (compare landform shapes).

Lesson Duration: 60 minutes

Lesson Focus: Understanding erosion, the role of vegetation in preventing erosion, and the concept of stormwater runoff. ← Students will do something aligned to the standards about landform Identification, but also recognizing that landforms have a direct relationship to how water moves and draining into rivers/streams/oceans.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Recognize how water flows from high ground to low ground
2. Recognize how water collects in low-ground (Can that make better sense?)
3. Understand the role of vegetation in preventing erosion and managing stormwater runoff.
4. Connect their observations of the schoolyard's landscape with how water moves and the importance of plants in the water cycle.

Materials Needed:

- Tin trays (cookie sheets)
- Wax Paper
- Spray bottles (small)
- Crayola Markers
- Journals or worksheets for observations
- Whiteboard and markers
- Vocabulary cards with terms: Erosion, Runoff, Vegetation, Watershed, Infiltration

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Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

- **Objective**: Refresh student's understanding of key terms related to water movement and erosion. Put these images on a screen to learn new terms. Key Vocabulary can be written/listed on the board. Try to include: ditch/erosion/mountain/hill/soil

Activity:

1. After reviewing vocabulary, break students into groups and give each group a tray and a sheet of wax paper.
2. Have students "whisper crumble" the wax paper and then unfurl it to lay it in the tray.
3. Provide students with 2 crayola markers. Have them go around their group and color the "ridge lines" with 1 color and the "valleys" with another color.
4. After a good bit of discussion among the groups, provide the spray bottles to "make it rain". Make it rain a LOT.
5. Use the key questions below to guide discussion of observations and optionally run the Landforms Kahoot. (for review)

Key Questions:

- What do we mean by "watershed"? (An area of land that drains water, like a bathtub.)
- What is the force that moves the water through the watershed?
- How are large watersheds made up of smaller watersheds?

Resource Links:

For Fun: Explore Google Maps Satellite View and River Runner

Supplemental Books:

"What Shapes the Land?" by Bobbie Kalman
- Lexile Level: 860L
- Explains processes like erosion and tectonic activity that shape land.

"Rivers and Streams" by Patricia Miller-Schroeder
- Lexile Level: 900L
- A focused look at flowing water systems and their role in shaping the land.

3- Watersheds and Beans

(Inspired by Project WET's Blue River Activity)

Lesson Plan: Modeling Landforms and Watersheds with Pasta

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

ESS.3.2.1 - Use models to compare Earth's salt and freshwater features (including oceans, seas, rivers, lakes, ponds, streams, and glaciers).
ESS.3.2.2 – Use models to compare Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands).
3.E.2 – Recognize how water flows from high to low ground and creates flooding risks. *(old standard)*

STEM Focus:

Cause-effect modeling, hydrology basics, group collaboration

ELA Extensions:

W.3.1 – Write opinion pieces (e.g., where *not* to build a house).
W.3.7 – Conduct short research projects (e.g., about local watersheds).
SL.3.1 – Engage in collaborative discussions and presentations.

Math Extensions:

3.MD.2 – Measure liquid volumes (using cups of beans as proxies).
3.MD.4 – Generate measurement data and represent it with a line plot (e.g., record counts of different stream flows).
3.OA.1 – Interpret multiplication in equal groups (e.g., beans per tributary).

Lesson Duration: 60 minutes

Lesson Focus: Students will "act out" a river system with tributaries flowing into a main stem, draining to a "mouth". ← Students will do something aligned to the standards about landform Identification, but also recognizing that landforms have a direct relationship to how water moves and draining into rivers/streams/oceans.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Recognize how water flows from high ground to low ground
2. Recognize how water collects in low-ground (Can that make better sense?)
3. Identify parts of a watershed that may receive more drainage/flow than others.
4. Connect their observations of the schoolyard's landscape with how water moves and the importance of plants in the water cycle.

Materials Needed:

- 2-3 types of pasta/beans
- 7 Solo-sized cups
- Optional: Journals or worksheets for observations

Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

- **Objective**: Refresh student's understanding of key terms related to water movement and erosion. Put these images on a screen to learn new terms. Key Vocabulary can be written/listed on the board. Try to include: ditch/erosion/mountain/hill/soil

Activity:

1. Helpful Hint: Before you go into class, know which stream/river is closest to the campus. Use this website to determine the watershed name, main stem, and at least 3 tributaries to that main stem.
2. Take students outside and arrange them, shoulder to shoulder, as a 5-7-person main stem, and two 3-5 person tributaries.
3. Hand cups with beans to the 3 "headwaters" and 4 empty cups to the "mouth".
4. Set a timer for 30-second "seasons" and let the students pass beans downstream for each season.
    a. Be sure to announce storms/hurricanes to allow for an increase in pasta (streamflow).
5. After each season, have the "mouth" switch to an empty cup to collect the water. This will allow for each season to result in a different flow pattern.
    a. Note: If students go to pass a bean, and there's nowhere to pass it, they must drop the bean on the ground- this models flooding.

Key Questions:

- Where did the water collect? (in the confluence and at the mouth)
- How does this model flooding?
- If you were to build a house, where might you build it? (Not at the confluence!)

- What are the functions of the headwaters?
- How do the seasons and weather influence the water quantity in the stream?

Resource Links:

For Fun: Explore Google Maps Satellite View and River Runner

Supplemental Books:

"A River Ran Wild" by Lynne Cherry
- Lexile Level: 860L
- Tells the story of the Nashua River, its ecological history, and efforts to restore it.

"Follow the Water from Brook to Ocean" by Arthur Dorros
- Lexile Level: 660L
- Explains how water moves through the water cycle and follows a river's journey from source to sea.

"Rivers and Streams" by Patricia Miller-Schroeder
- Lexile Level: 900L
- Covers how rivers form, flow, and shape the land, including watersheds and the journey to the ocean.

"Watersheds: A Practical Handbook for Healthy Water" by Clive Dobson and Gregor Gilpin Beck
- Lexile Level: Approximately 1000L (not officially listed but inferred from vocabulary and structure)
- A comprehensive guide to how watersheds work and how rivers drain them.

"River Discoveries" by Ginger Wadsworth
- Lexile Level: 950L
- Explores the biodiversity and flow of a river from its source to its mouth.

4- Rainy Day Walk/Looking for Stormwater/Erosion

Lesson Plan: Finding Stormwater on Campus (Best Done during or right after rain event!)

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

E.3.2 – Identify features of erosion, runoff, and man-made impacts. *(old standard)*
LS.3.3.1 - Conduct investigations to explain how environmental conditions determine how well plants survive and grow.
LS.3.3.2 - Develop explanations to infer how properties of soil determine its ability to support growth and survival of plants.

STEM Focus:

Inquiry-driven data collection, field journaling, environmental systems

ELA Extensions:

W.3.3 – Write narratives to develop real or imagined experiences or events using clear event sequences.
W.3.6 - Recall or gather information, take notes, and sort evidence into categories.
SL.3.5 – Use drawings and visuals to clarify findings during group share-outs.

Math Extensions:

3.MD.2 – Estimate and measure puddle sizes (volume or surface area).
3.MD.3 – Create line plots or bar graphs from observational data.

Lesson Duration: 60 minutes

Lesson Focus: Students will explore their own campus to find how water moves, where it collects, and how that water movement impacts the land.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Identify pervious and impervious surface coverage on campus.
2. Identify areas that collect water after rain events.
3. Identify storm drains and infrastructure around campus to allow drainage.

4. Identify areas on the campus where human activity has impacted how water flows.

Materials Needed:

- This activity can be done without any materials.
- White board/markers
- Google Maps Satellite View projected on screen
- Idea: Assign small groups and give each group a clip board/paper/pen. Each small group can have:
    - An illustrator (draws features where they find water or signs of water)
    - A labeler (labels the parts of the drawing with appropriate vocabulary)
    - The Lookout (person who finds signs of water and how humans impact how water flows)

Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

- **Activate Prior Knowledge:** Ask students where the water goes when it falls as rain. Students can share vocabulary relating to drainage/watersheds including: erosion, flooding, puddles, ditch, etc.

Activity:

1. Project a Google Map on the screen of the school's campus.
2. Have students come up to the white board and identify areas that they predict will have standing/puddled water. (Kids know where water collects on their playground.)
3. Take students in small groups outside and ask students to take notes (on a clipboard) of where they find water on campus. They can draw or describe these observations on their paper.
4. Come back inside and have groups share their observations. Where did they find water and signs of water?

Key Questions:

- Where do we see areas with standing water/puddles?
- What is the importance of the vegetated areas during rain events?
- Where do we see signs that water has been here?
- Where does the water go or drain during rain events?

Resource Links:

Google Maps

Supplemental Books:

"All the Way to the Ocean" by Joel Harper

- Lexile Level: 800L
- Follows two boys as they learn how storm drains carry runoff (and pollution) to the ocean, helping children understand the impact of water movement in cities.

"Why Should I Save Water?" by Jen Green

- Lexile Level: 910L
- Covers water conservation, stormwater, and how people (including schools) can reduce waste and runoff.

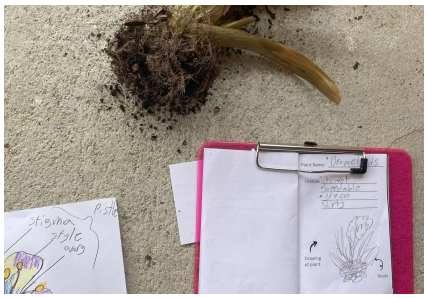
"Drainage! How Stormwater Runs Off" by Molly Aloian

- Lexile Level: 980L
- A child-friendly book about how cities deal with stormwater and runoff, including infrastructure like drains and catch basins—applicable to schools.

"Down Comes the Rain" by Franklyn M. Branley

- Lexile Level: 740L
- Explains the water cycle and how rain affects the ground and buildings; good for setting up understanding of runoff and flooding.

5- Root Observation Lab



Lesson Plan: Root Observations

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

LS.3.2.1 – Understand plant parts and root functions.
LS.3.3.1 - Conduct investigations to explain how environmental conditions determine how well plants survive and grow.
LS.3.3.2 - Develop explanations to infer how properties of soil determine its ability to support growth and survival of plants.

STEM Focus:

Botanical drawing, data collection, anatomical comparison

ELA Extensions:

W.3.5 - Conduct short research projects that build knowledge about a topic.
W.3.6 - Recall or gather information, take notes, and sort evidence into categories.
L.3.1 – Use precise language and scientific vocabulary to demonstrate command of the conventions of standard English grammar.
L.3.4 - Determine and clarify the meaning of unknown and multiple-meaning words and phrases.

Math Extensions:

3.MD.1 – Tell and write time such as recording time spent at stations or growth durations.
3.MD.3 – Represent and interpret scaled picture and bar graphs such as using tally marks and graphs to show types of root shapes or traits.

Lesson Duration: 60 minutes

Lesson Focus: Students will experience what it's like to soak up water through roots by simulating the process using different diameter straws. Students may notice that different shapes/diameters of straws will impact how much water the plant needs.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Describe different root structures, sizes, and functions.
2. Compare/contrast the movement of water through a root system.
3. Create drawings and observations based on the shape and quantity of different plant root examples.

Materials Needed:

- 3-5 plants. These can be on the clearance rack at a local home store. Dead plants actually work well!
- Plant Observation Booklet for students to record observations.

Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

Activate Prior Knowledge: Ask students to turn and talk with their neighbor to think of at least 2-3 things roots do. What is the function of a root system?

Activity:

1. Bring in 3-5 examples of plants with roots. Set these plants up in "stations", ideally outside.
2. Break students into groups to visit each type of plant.
3. Have students complete these Plant Observation booklets to record observations of each type of plant and its roots.
4. After they have observed different types of roots, have them share their observations with the class.
5. Be sure students recognize that roots soak up water (process water) and stabilize the ground by holding it like fingers.

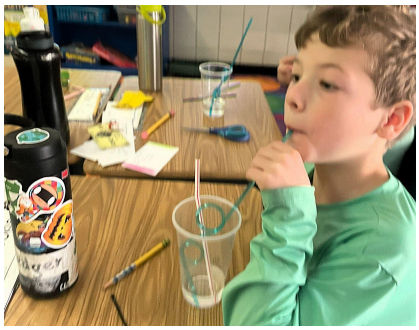
Key Questions:

- Why are some roots straight? Others are curly?
- How might the shape of a root help the plant stay strong?
- How might the diameter of the root impact how much water it soaks up (processes?)

Resource Links:

Video of how a root forms: https://youtu.be/Y6vgAnMhGxs

6- Root Processing Lab/Wheat Grass Seed Planting



Lesson Plan: Root Processing Lab

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

LS.3.2.1 - Conduct investigations to explain the structures and functions of plants.
LS.3.2.2 - Use models to exemplify and explore how root types vary and impact the life cycle of plants.

STEM Focus:

Experimental design, physical modeling, water uptake measurement

ELA Extensions:

RI.3.1 – Ask and answer questions from an informational text (paired article/video on root systems).
W.3.2 – Write an informative/explanatory text in response to which root type "worked best."

Math Extensions:

3.MD.2 – Measure and compare water “uptake” across straw types.
3.OA.3 – Represent, interpret, and solve one-step problems such as multiplying to find total water per root type in a group setting.

Lesson Duration: 60 minutes

Lesson Focus: This lab allows students to experience what it may be like to be a root.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Describe how roots process water.
2. Demonstrate the movement of water through a root system.
3. Create data based on the amount of water each type of “root” can process.

Materials Needed:

- 3 types of straws (stirring straws, regular, krazy, or Smoothie)
- 1 cup per student
- Sharpies (to mark water levels on cups)
- Bag of wheat grass seeds

Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

- **Activate Prior Knowledge:** Ask students to turn and talk with their neighbor to identify at least 2-3 functions of a plant's root system. They should be able to at least say that the roots are usually under ground.

Activity:

1. Provide students with 1 clear cup half-full of water (like pictured).
2. Provide students with 3 types of straws.
3. Set a timer for 5 seconds and let students pretend to be roots- drink as much as they can in those 5 seconds.
4. After each 5-second stint, have students mark on their cup how much they drank.
5. Refill each cup to the mark after each 5-second stint.
6. Using Key Questions below to guide students to recognize how various root shapes/diameters impact how much water they can consume.
7. **Bonus**: Give students small (maybe 10-15 seeds) amounts of wheat grass. Ask them to go dig a little hole anywhere within a designated area to plant their grass.
8. Be prepared to come back in about a week and make observations about where it grew and where it didn't grow!

Key Questions:

- Was there a difference between using the wide straw and the narrow straw?
- How was the process different using the different types of straws?
- How is this activity similar to how roots process water?
- If you were a plant, which type of root would you prefer? (It may differ depending on where you are located, arid/damp climate, etc.)

Resource Links:

For Fun: Explore Google Maps Satellite View and River Runner

7- Permitting for Vegetative Planting

Lesson Plan: Permitting for Vegetative Planting

Subject: Earth Science (Landforms, Water, and Erosion)

NC Standards:

E.3.2 – Identify features of erosion, runoff, and man-made impacts. *(old standard)*
3.L.2.3 – Understand how humans impact environments and choose appropriate plants. *(old standard)*
LS.3.3.1 - Conduct investigations to explain how environmental conditions determine how well plants survive and grow.
LS.3.3.2 - Develop explanations to infer how properties of soil determine its ability to support growth and survival of plants.

STEM Focus:

Design thinking, place-based science, decision-making

ELA Extensions:

W.3.1 – Write opinion pieces on topics that support a point of view with reasoning such as a persuasive "permit" explaining planting choice.
SL.3.6 – Acquire and use accurately grade-appropriate, general academic, and domain-specific words and phrases to present planting plans orally to a "planning board."

Math Extensions:

3.MD.4 – Create a map/graph with different planting areas. *(old standard)*
3.MD.5 – Calculate and discuss area (e.g., how much space the plant will need).
3.MD.8 - Calculate and discuss perimeters of polygons to calculate plant space.

Lesson Duration: 60 minutes

Lesson Focus: Students will decide what type of vegetation they should plant somewhere on campus. Students will determine an appropriate location based on the needs of the plant and the function of its roots. Students can choose from a native grass option and a native shrub option, depending on their campus' environment.

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Describe the function of the plant in a specific location (processes water, stabilizes the ground).
2. Describe the stormwater function of a plant (soak it up, slow it down, spread it out).
3. Compare locations around their campus based on the water drainage, human impact, and surface coverage.

Materials Needed:

- Print out Vegetative Permit Cards
- Use the NC Native Plant Society Plant Finder to search for one native grass and one native shrub that grows in your region. Look for species that do well in sunny or wet conditions depending on the planting area you've selected.

Lesson Breakdown:

1. Warm-Up and Vocabulary Review (10 minutes)

- **Activate Prior Knowledge:** Have students turn and talk to identify at least 3 vocabulary terms related to watersheds, drainage, and plants. List these terms on the board.

Activity:

1. Take students outside to walk around their campus. Instruct them to either work in groups or independently to find an area that could be suitable for planting either a shrub or a grass.
2. Remind students to consider the root structure of the grass or the shrub- what type of area would they like? Lots of humans walking around them? Lots of water flowing past them? Just think about the plant's features and how they may need different areas to grow.
3. Allow students to complete their Vegetative Permit Cards.
    a. **Bonus**: Laminate these cards and allow students to place these cards in the specific location they'd like to plant.
4. Have students present their Vegetative Permit Cards to the class or the "planning board" of adults who may offer feedback for their planting concept.

Key Questions:

- Will your plant slow water down when it's flowing? Spread the water out when it rains? Or soak up a lot of water that may collect in that area?

Resource Links:

Green Stormwater/SSSs of Stormwater Video: https://youtu.be/O8mi2F1Hfho